



STATE OF WASHINGTON
STATE BUILDING CODE COUNCIL

May 2018
Log No. _____

1. State Building Code to be Amended:

- | | |
|---|---|
| <input checked="" type="checkbox"/> International Building Code | <input type="checkbox"/> International Mechanical Code |
| <input type="checkbox"/> ICC ANSI A117.1 Accessibility Code | <input type="checkbox"/> International Fuel Gas Code |
| <input type="checkbox"/> International Existing Building Code | <input type="checkbox"/> NFPA 54 National Fuel Gas Code |
| <input type="checkbox"/> International Residential Code | <input type="checkbox"/> NFPA 58 Liquefied Petroleum Gas Code |
| <input type="checkbox"/> International Fire Code | <input type="checkbox"/> Wildland Urban Interface Code |
| <input type="checkbox"/> Uniform Plumbing Code | |

For the Washington State Energy Code, please see specialized [energy code forms](#)

Section(s):

202 Definitions
2205 Structural Steel

Title: Greenhouse Gas Emissions Reduction for Steel Products

(e.g: Footings for wood foundations)

2. Proponent Name (Specific local government, organization or individual):

Proponent: New Buildings Institute
Co- Proponents: Carbon Leadership Forum and RMI
Title: Non profit organization
Date: April 8, 2022

3. Designated Contact Person:

Name: Webly Bowles
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4. Proposed Code Amendment. Reproduce the section to be amended by underlining all added language, striking through all deleted language. Insert new sections in the appropriate place in the code in order to continue the established numbering system of the code. If more than one section is proposed for amendment or more than one page is needed for reproducing the affected section of the code, additional pages may be attached.

Clearly state if the proposal modifies an existing amendment or if a new amendment is needed. If the proposal modifies an **existing amendment**, show the modifications to the existing amendment by underlining all added language and striking through all deleted language. If a new amendment is needed, show the modifications to the **model code** by underlining all added language and striking through all deleted language.

Code(s) Washington State Building Code _____ Section(s) 202, 2205

Enforceable code language must be used.

Amend section to read as follows:

Chapter 2 Definitions

Section 202 Definitions

Add new definitions as follows:

Carbon dioxide equivalent (CO₂e). A measure used to compare the impact of various greenhouse gases based on their global warming potential (GWP). CO₂e approximates the time-integrated warming effect of a unit mass of a given greenhouse gas relative to that of carbon dioxide (CO₂).

Global warming potential (GWP). A ~~is an~~ index for estimating the relative global warming contribution of atmospheric emissions of 1 kg of a particular greenhouse gas compared to emissions of 1 kg of CO₂. The following GWP values are used based on a 100-year time horizon: 1 for CO₂, 25 for methane (CH₄), and 298 for nitrous oxide (N₂O).

Chapter 22 Steel

Section 2205 Structural Steel

Add new section as follows:

2205.3 Embodied CO₂e in structural steel products. Structural steel, hollow steel section, steel plate, and concrete reinforcing bar used in the building project's ~~primary structural frame, lateral force resisting system, secondary structural members, and foundations~~ shall comply with Section 2205.3.1, ~~and either 2205.3.2 or 2205.3.3.~~

Exceptions:

1. Projects less than 50,000 square feet.
2. ~~Projects where the total cost of the structural steel in Table 2205.3.2 is less than 5% of the total project value.~~

2205.3.1 Documentation of CO₂e. Confirmation of a product's Environmental Product Declarations (EPD) shall be submitted for 75% of ~~total~~ structural steel products used in the building's ~~primary structural frame, lateral force resisting system, secondary structural members, and foundations~~, based on cost or weight. ~~Confirmation of the product's~~ All A letter from a registered design professional confirming EPDs for products used in the building shall be provided to the AHJ prior to certificate of occupancy.

2205.3.1.1 Requirements for EPD. ~~CO₂e content shall be documented for 75% of the total structural steel products must~~ shall have by a product-specific cradle-to-gate Type III EPD complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database.

Exception: Where Type III industry wide EPDs are allowed in Section 2205.3.23.

22.05.3.2 CO₂e Limits per Steel Product. The maximum CO₂e for 75% individual structural steel members used in the building shall not exceed the values specified in Table 2205.3.3 based on the steel product and either the milled or fabricated CO₂e.

Table 2205.3.2 CO₂e Limits per Steel Product

	<u>Steel Product</u>	<u>Milled Steel kg CO₂e/kg^a</u>	<u>Fabricated Steel kg Co₂e/kg^b</u>
<u>Structural Steel</u>	<u>Hot Rolled Structural Sections</u>	<u>1.75</u>	<u>2.14</u>
<u>Structural Steel</u>	<u>Hollow Structural Sections</u>	<u>2.99</u>	<u>3.48</u>
<u>Structural Steel</u>	<u>Plate</u>	<u>2.57</u>	<u>3.03</u>
<u>Reinforcing Bars</u>		<u>0.89</u>	<u>0.98</u>

a: Applies when an EPD declares mill only material (cradle to mill gate).

b: Applies when an EPD declares mill material plus U.S. industry average fabrication impacts (cradle to fabricator gate), or there is a fabricator EPD.

2205.3.23 Steel Production. A minimum of 75% of steel products listed in this section, based on cost or weight, shall be produced in a facility or facilities that comply with one of the following:

1. On the date of procurement is independently, or as part of an aggregation of facilities, a Green Power Partner in the United States Environmental Protection Agency (U.S. EPA) Green Power Partnership program, or an equivalent renewable power procurement registry as approved by the AHJ.
2. Not less than 50% of the energy sourced for production at the facility is a renewable energy resource as documented from one or more of the following:
 - 2.1. On site renewable energy system
 - 2.2. Off site renewable energy system owned by the production facility owner
 - 2.3. Community renewable energy facility
 - 2.4. Physical Renewable Energy PPA
 - 2.5. Financial Renewable Energy PPA

22.05.3.3 CO₂e Limits per Steel Product. The maximum CO₂e for 75% individual steel members used in the building shall not exceed the values specified in Table 2205.3.3 based on the steel product and either the milled or fabricated CO₂e.

Table 2205.3.3 CO₂e Limits per Steel Product

	<u>Steel Product</u>	<u>Milled Steel kg CO₂e/kg^a</u>	<u>Fabricated Steel kg Co₂e/kg^b</u>
<u>Structural Steel</u>	<u>Hot Rolled Structural Sections</u>	<u>0.99</u>	<u>1.22</u>
<u>Structural Steel</u>	<u>Hollow Structural Sections</u>	<u>1.71</u>	<u>1.99</u>
<u>Structural Steel</u>	<u>Plate</u>	<u>1.47</u>	<u>1.73</u>

<u>Reinforcing Bars</u>		<u>0.89</u>	<u>0.98</u>
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a: Applies when an EPD declares mill only material (cradle to mill gate).

b: Applies when an EPD declares mill material plus U.S. industry average fabrication impacts (cradle to fabricator gate), or there is a fabricator EPD.

6.5. Briefly explain your proposed amendment, including the purpose, benefits and problems addressed.

Specifically note any impacts or benefits to business, and specify construction types, industries and services that would be affected. Finally, please note any potential impact on enforcement such as special reporting requirements or additional inspections required.

Summary:

This code change proposal will support Washington's climate goals. Washington has been a leader in sustainable building practices, including recent legislation to study the procurement of low carbon building materials in state projects. This proposal uses existing policy mechanisms to safeguard the public from the hazards associated with the creation of building materials and supports state GHG emission reduction goals. **The proposal requires 75% of all structural steel products to ~~meet specific global warming potential (GWP) limits and document compliance through~~ have environmental product declarations (EPD).**

Problem:

Building operations and building construction are responsible for 39% of today's global carbon emissions.¹ About 11% of these emissions are embodied carbon emissions, the emissions associated with the creation of building materials and construction activities.¹ Unlike operational emissions, which can be improved over the lifespan of a building through deep-energy retrofits and the decarbonization of the electric grid, embodied carbon emissions occur before a building is occupied and cannot be reduced over time. Therefore, addressing embodied carbon in the construction of buildings presents an urgent and valuable opportunity to reduce carbon emissions in Washington.

As the Washington energy code continues to improve building energy efficiency and the grid energy becomes cleaner, operational carbon emissions will be reduced, and embodied carbon will become a larger part of a building's total carbon emissions. The materials chapters of the IBC have been in place and used by the design and construction industry to ensure that building materials in the built environment preserve public health and safety.

This proposal looks to expand the impact of the IBC to further safeguard the public from the hazards associated with the creation of building materials. The approach presented within this code change proposal, EPD reporting ~~and GWP~~ targets for the highest embodied carbon and most used construction products, supports a path toward a decarbonized built environment. **The proposed language will encourage the ~~worst 10% of steel product manufacturers to reduce the carbon content of their materials to be more competitive in the market~~ material disclosure and provide consumer choice on important environmental aspects of products.**

Aligned State Policy:

In 2019, Washington ranked fifth in the U.S. for commercial construction growth at \$8.5 billion. Building permits grew 7.6% from 2014 to 2019 and are expected to continue to grow across the state, purchasing billions in high carbon construction products.

To meet state GHG goals, both operational and embodied carbon should be addressed, as stated in the State 2021 Energy Strategy. Washington legislators know the important role that embodied carbon plays in a carbon neutral future because they have reviewed the facts. In 2018, 2021, and 2022, Buy clean policies were introduced in the Washington legislature. In 2018, 2020, and 2021 Governor Jay Inslee signed executive orders and announced activities surrounding low carbon construction for state projects.

Additionally, in 2021, the WA legislature funded two provisos to support the creation of a Buy Clean Buy Fair Reporting Database. Cities and counties are also introducing policies and programs to reduce embodied

¹ *Bringing Embodied Carbon Upfront: Coordinated Action for the Building and Construction Sector to Tackle Embodied Carbon*, World Green Building Council, 2019.

carbon, such as the King County Climate Action Plan and the City of Seattle Green Building Incentive Program, which both include requirements related to embodied carbon.

The Opportunity:

Steel is one of the most widely used materials in building construction and a primary contributor to embodied carbon in buildings, second only to traditional concrete. The U.S. steel industry is responsible for 104.6 MMT of CO₂ emissions annually, a contribution that makes up 2% of total U.S. emissions. Steel destined for the built environment is responsible for 46 MMT of CO₂ emissions annually, nearly half of the total annual emissions from the steel industry.²

Many types of steel products made with different manufacturing techniques are found in buildings. Structural steel sections are the predominant structural framing material used in building construction, holding 46% of the market share for structural framing materials for nonresidential and multistory residential construction in 2017.³ Steel reinforcing or "rebar," typically embedded in structural concrete, can also be a major use of steel and a source of embodied carbon in buildings.

A recent case study analysis by RMI shows that simply by specifying rebar products with lower CO₂e content, a typical commercial construction project's embodied carbon can be reduced up to 10%.⁴ The report also states that products with higher recycled content have lower embodied carbon values. The Nucor Bar Mill near Seattle produces reinforcing bars with some of the highest recycled content values at 97.4%.⁵

Washington can drive significant embodied carbon reductions through regulations that address the reduction of CO₂e in steel products used in building construction. Including embodied carbon considerations in the building code will decrease the carbon impact of the state's building construction industry and support local economic development towards low carbon business models.

Although steel is one of the most widely used materials in constructing new buildings, few steel manufacturers provide EPDs for their products. An EPD discloses a product's environmental impact, including the product's carbon dioxide equivalent (CO₂e) as represented as GWP. GWP is the most common metric for measuring and evaluating materials' greenhouse gas emissions over a product or building's lifecycle, also called embodied carbon. Third-party rating systems like LEED, and procurements policies like the U.S. General Services Administration's (GSA) Recommendations for Procurement of Low Embodied Carbon Materials,⁶ have put demand on building product manufacturers to disclose the environmental impacts of their products. Still, steel manufacturers have been slow to respond to these requests.

GWP Value Methodology:

~~The proponent collected the publicly available steel EPDs to analyze what GWP limits would support the design and construction industry's awareness of embodied carbon and indicate what percentage of construction material suppliers could comply with the values proposed. The values presented encourage the worst 10% of steel product manufacturers to reduce the carbon content of their materials to be more competitive in the market.~~

~~The current EPD regional data pool for structural steel, hollow steel sections, and steel plate is not yet sufficient to support a code requirement that applies CO₂e limits for these materials. However, industry-wide EPDs provide a datapoint, disclosing a GWP that ~90% of the reporting companies' products can~~

² [Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990–2018](#), US Environmental Protection Agency, 2020.

³ [Structural Steel: An Industry Overview](#), American Institute of Steel Construction, 2018.

⁴ Matt Jungclaus, Rebecca Esau, Victor Olgay, and Audrey Rempher, *Low-Cost, High-Value Opportunities to Reduce Embodied Carbon in Buildings*, RMI, 2021.

⁵ [2020 Recycled Content of Nucor Steel Mill Products](#), Nucor, 2021.

⁶ [GSA Green Building Advisory Committee Advice Letter: Policy Recommendations for Procurement of Low Embodied Energy and Carbon Materials by Federal Agencies](#), U.S. General Services Administration, 2021.

achieve. The proposal GWP value is based on 175% of the industry average as identified in the American Institute of Steel Construction and Steel Tube Institute's Type III industry-wide EPD. Setting GWP limits for structural steel sections, steel plate, and hollow structural sections at 175% of the industry average allows a wide range of complying manufacturers and encourages the bottom 10% of the industry to improve. In addition, the steel industry EPDs are based primarily on American steel information meaning that American efficiency is setting the standard, often requiring imported steel to rise to a higher efficiency level. Disclosure of CO₂e content in steel is a critical first step in increasing a regional supply of data that can eventually be used to apply CO₂e limits to reduce the environmental impact of steel used in building construction. By requiring the reporting of EPDs for structural steel and rebar, demand for EPDs for steel products will increase and prime the market for future regulation.

Reporting:

Anticipated reporting requirements might include a stamped and signed letter from a licensed design professional and summary table of structural steel GWP/EPDs. AHJ may request that a plan for reporting material GHG emissions be provided at the time of permit. This proposal will not have limited impact on the plan review or the inspection process.

Design, construction, and product manufacturers will need to work together to collect and achieve and report the embodied carbon results retain the EPDs. Designers will include the requirement for steel product GWP/EPDs requirements in project specifications and review the cutsheets as contractors select and provide submittals for the designers to review.

7.6. Specify what criteria this proposal meets. You may select more than one.

- The amendment is needed to address a critical life/safety need.
- The amendment clarifies the intent or application of the code.
- The amendment is needed to address a specific state policy or statute.
- The amendment is needed for consistency with state or federal regulations.
- The amendment is needed to address a unique character of the state.
- The amendment corrects errors and omissions.

8.7. Is there an economic impact: Yes No

If no, state reason:

The impact of the embodied carbon considerations in code to project teams has been shown to be cost-neutral when the requirements are specified and administered efficiently.

~~The GWP limits were established for steel products using a percentage of the Type III industry-wide EPDs for each product, considering whether the product is directly from the mill or fabrication. The evaluated rebar EPDs represent 90% of the industry's products, allowing the GWP limit to be based on the studied EPDs. The steel GWP values are set for 90% of the industry's American products to comply. The energy related to steel product manufacturing dominates the calculated embodied carbon of the final product. Therefore, products manufactured with electricity, over natural gas, and in regions, like the Northwest, with lower carbon energy grids will have lower embodied carbon. International steel production's energy is sourced from more extensive coal and natural gas percentages than in the U.S., making American-made steel lower in carbon than most steel derived from China.~~

At the project level, collecting and tracking structural steel EPDs adds minimal time to include the requirements in the project specifications, product procurement product, and submittal review process. Product specifications are part of any architectural project and collecting complying documentation is part of the project.

CLF has conducted research to show that when tracking and reducing product GWP values for an office town in Bellevue, Washington, the project was able to reduce the embodied carbon of structural steel, compared to the baseline at no additional cost.

To comply with the code, small product manufacturers and/or suppliers will see a small financial impact from the development of EPDs for their products if they do not already have an EPD. A study by Energy Transitions Commission showed that the company pass-through cost to the individual projects to create the initial \$5-30K EPD is negligible.⁷

If yes, provide economic impact, costs and benefits as noted below in items a – f.

- a. **Life Cycle Cost.** Use the OFM Life Cycle Cost [Analysis tool](#) to estimate the life cycle cost of the proposal using one or more typical examples. Reference these [Instructions](#); use these [Inputs](#). Webinars on the tool can be found [Here](#) and [Here](#)). If the tool is used, submit a copy of the excel file with your proposal submission. If preferred, you may submit an alternate life cycle cost analysis.
- b. **Construction Cost.** Provide your best estimate of the construction cost (or cost savings) of your code change proposal.

\$Click here to enter text./square foot

(For residential projects, also provide \$Click here to enter text./ dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

- c. **Code Enforcement.** List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:
- d. **Small Business Impact.** Describe economic impacts to small businesses:
- e. **Housing Affordability.** Describe economic impacts on housing affordability:
- f. **Other.** Describe other qualitative cost and benefits to owners, to occupants, to the public, to the environment, and to other stakeholders that have not yet been discussed:

Please send your completed proposal to: sbcc@des.wa.gov

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

⁷ Mission Possible: Reaching Net-Zero Carbon Emissions From Harder-to-Abate Sectors by Mid-Century, Energy Transitions Commission, 2018.